Two seminars on the same topic were done in the fall of 2011.

Presenter: Teppei J. Yasunari (USRA)

1st seminar

Date: Nov. 28, 2011

Place: Hokkaido University, Sapporo, Japan

Title (translated from Japanese): The various influences due to aerosol depositions

2nd seminar

Date: Dec. 1, 2011

Place: National Institute of Polar Research, Tokyo, Japan

Title (translated from Japanese): Incorporation of the mass concentration and the new snow albedo schemes into the global forecasting model, GEOS-5 and the impact of the new schemes over Himalayan glaciers

(The study on the GEOS-5 at NASA/GSFC)

Recently the issue on glacier retreats comes up and many factors should be relevant to the issue. The absorbing aerosols such as dust and black carbon (BC) are considered to be one of the factors. After they deposited onto the snow surface, it will reduce snow albedo (called snow darkening effect) and probably contribute to further melting of glacier. The Goddard Earth Observing System version 5 (GEOS-5) has developed at NASA/GSFC. However, the original snowpack model used in the land surface model in the GEOS-5 did not consider the snow darkening effect. Here we developed the new snow albedo scheme which can consider the snow darkening effect. In addition, another scheme on calculating mass concentrations on the absorbing aerosols in snowpack was also developed, in which the direct aerosol depositions from the chemical transport model in the GEOS-5 were used. The scheme has been validated with the observed data obtained at backyard of the Institute of Low Temperature Science, Hokkaido University, by Dr. Teruo Aoki (Meteorological Research Institute) et al. including me. The observed data was obtained when I was Ph.D. candidate. The original GEOS-5 during 2007-2009 over the Himalayas and Tibetan Plateau region showed more reductions of snow than that of the new GEOS-5 because the original one used lower albedo settings. On snow cover fraction, the new GEOS-5 simulated more realistic snow-covered area comparing to the MODIS snow cover fraction. The reductions on snow albedo, snow cover fraction, and snow water equivalent were seen with statistically significance if we consider the

snow darkening effect comparing to the results without the snow darkening effect. In the real world, debris-cover, inside refreezing process, surface flow of lacier, etc. affect glacier mass balance and the simulated results immediately do not affect whole glacier retreating. However, our results indicate that some surface melting over non debris-covered parts of the glacier would be explained by the snow darkening effect. Further discussion and observations are necessary to assess the glacier issue.